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Satellite Investigation to study POcket BEach Dynamics in Malta. The SIPOBED project

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Pocket Beaches are small beaches limited by natural headlands, strongly jutting into the sea, free from direct sedimentary contributions that are not eroded from back-shore cliffs. Malta's pocket beaches are one of the most significant geomorphologic features of the archipelago. They play an important role for a variety of ecological and economic reasons. In this sense, sediment (mostly sand) dynamics is the most relevant factor to consider in the beach system. Sediment movement can be driven by a variety of factors, including wave action, currents, wind and direct and indirect anthropic action, leading to extreme morphological modifications in some cases.

The SIPOBED (Satellite Investigation to study POcket BEach Dynamics) project seeks to develop a reliable and cost-effective tool capable of monitoring sediment dynamics using satellite and other remote sensing data in several selected Maltase Pocket Beach systems, by reconstructing the volume and distribution of sediment of the beaches system through time.

The monitoring of sandy coastal zones requires the analysis of sediment dynamics in the entire beach system, from the coastal dunes to the closure depth, where the influence of sea waves on the seabed is low. SIPOBED uses Interferometric SAR and Light Detection and Ranging (LIDAR) derived Digital Elevation Models (DEMs) to study the inland system dynamics. The DEMs are used to improve the co-registration of temporal SAR imagery and detect subtle changes between acquisitions. The underwater sediment dynamics monitoring is approached by tracking bathymetric changes using multispectral satellite and unmanned aerial vehicle (UAV) images. In situ bathymetric data is essential for calibrating and validating the model. This methodology allows for more frequent and cost-effective monitoring of changes in both the dune-beach system and the ocean floor compared to classical approaches, such as in situ topographic surveys and ship-based sonar surveys. The project also aims to determine the bedrock depth and geometry at the lower limit of the pocket beach system using near-surface geophysical techniques.

The monitoring of Maltese sandy coastal beaches can provide insights into the factors influencing sediment dynamics and improve our understanding of the processes that shape and reshape pocket beaches over time. The results of the SIPOBED project will contribute to developing a risk assessment and monitoring tool that combines the sediment dynamics process with their potential local impacts, resulting in a powerful instrument for decision-makers.

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